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Analysing productive use of domestic water and wastewater for urban livelihoods of the poor – a study from Accra, Ghana.

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Using Accra as an example, the paper records the different urban livelihood activities that utilize domestic water/wastewater, quantifies such use and presents a framework for planning multiple uses in an urban context. The paper provides insights to city planners, water authorities, and researchers on the wide range of 'other uses' that urban domestic water supply and wastewater is utilized for and how to quantify such use. From preliminary findings we conclude that the interests of people who use domestic water for livelihood purposes can be better accounted for under conditions of improved access, which will reduce the price they pay for water and increase their profit margin. The constraining factor for making productive use of water is not so much water shortage, as inequity of water access in the city. In the case of wastewater, managing the risk is essential for ensuring sustainability of these livelihoods.

Introduction

Coastal Accra is situated in the Odaw-Korle catchment, and has a population of 1.66 million (within its current administrative boundary covering 240 sq km) and a population growth rate of 3.4% annually. The big city attracts people from rural areas in search of job opportunities and a better life. However, within Greater Accra, the 1992 Ghana Living Standards survey indicates that the poverty index is 20.8%, suggesting that there are 345280 people with a daily minimum wage of just under 2 USD per day (as of March 2006). It is not surprising therefore that 60% of the population lives in what are known as high density low income settlements. They seek livelihood opportunities that require a minimum capital outlay and many of these center around servicing the material needs of people. These types of "businesses" or small scale commercial activities are not officially registered and are therefore difficult to keep a track of. Many of these are also water dependent, but what is of interest is that the water used is not recognized as commercial water or water for livelihoods. Rather it is one of the "hidden" multiple uses to which urban domestic water is put.

The increasing demand for and use of domestic water in the city, simultaneously translates into wastewater generation. What is little known in most developing cities, and Accra is no exception, is that wastewater (including storm water runoff and all polluted surface water sources like city waterways) too, is used for multiple purposes by the poor. Notably, wastewater from cities which planners traditionally see as "useless", is a potential "water resource" popularly providing water (and nutrients) for irrigated urban agriculture.

Productive use of water is usually defined as the use of water to promote economic growth and improve livelihoods such as watering food-lots and livestock. Applying this concept to (treated) domestic water use, the case studies found in MUS literature, mostly address use of domestic water in a rural or small town context, for livelihoods activities centered on backyard irrigation, small scale livestock keeping, brick-making etc. Apart from a report for India (Verhagen & Bhatt, 2006) which discusses an urban context, and for Bolivia (CentroAGUA & IRC, 2005), where the peri-urban context of community supplies providing for multiple uses is presented; not much work has been done on the urban livelihoods dimension of urban water supply nor on the productive use of wastewater which also represents large volumes of "water" in an urban context. This paper attempts to present productive (multiple) use of water in a more inclusive manner by linking both urban water and wastewater into the urban livelihoods paradigm. The paper builds on

exploratory work presented by Abraham *et al.* (2007) which was based on a small sample survey of urban water livelihoods in 6 electoral areas of the Accra Metropolitan Area.

Enterprises run by the poor

Per capita domestic water supply is said to vary between 60 and 120 liters per capita per day (in the well served areas only) and 25 to 60 liters per capita per day when poor households buy water from vendors (Abraham *et al.*, 2007). These same households are involved in various income generating activities requiring water. Some are typical service sector enterprises like street food vendors, restaurants and chop bars, hair salons and beauty parlors, others are involved in livestock rearing, and floriculture and other small industry to mention the common ones.

From the wastewater side various small enterprises like car washing, and much of urban and peri-urban agriculture, thrive on this resource; this, despite the fact that irrigation with wastewater poses health risks to those using the wastewater and those consuming the produce, in this case vegetables. It is estimated that up to 90 % of the most perishable vegetables are grown in (peri-) urban areas (Obuobie et al, 2006) where the water quality of most of the water sources used, is marginal, due to the mixing of natural drainage water with untreated wastewater).

Where urban water infrastructure is poorly managed and unable to serve the local communities, these types of livelihoods closely depend on small scale water vendors or purchase of water from neighborhood taps at tariffs much higher than the official urban domestic water tariffs (van Rooijen *et al.*, 2008). The poor entrepreneur buys water for these purposes at exorbitant rates often exceeding even the official water utility commercial rates.

Livelihood approach to planning multiple use urban systems

As Moriarty and Butterworth (2003a) said in their overview paper, while livelihoods approaches are very helpful in examining, understanding, and planning a multi-role use of water, it should also be kept in mind that these approaches are in effect applied common sense, a point also made by Critchley & Brommer (2003). A good introduction to livelihoods terminology, concepts, and how they can be applied to the water sector is found in Moriarty and Butterworth (2003b). Essentially, the livelihoods approach can be summarized as gaining an understanding of how people's livelihoods work now, how they have changed over time and could be improved in the future, and of the critical opportunities for, and obstacles to doing so. For the urban water sector, taking a livelihoods approach means identifying the existing and potential role of water in people's livelihoods – productive, health, consumptive – and identifying sustainable and effective ways of meeting these needs. For this paper, we will limit the scope of water and wastewater generated urban livelihoods, to their income generating potential only. Additionally the water dependent livelihoods which will be discussed here are those that use water/wastewater to provide a service, and not the enterprises that sell water directly.

Quantifying productive use of water and wastewater in cities

Water

The traditional approach to 'basic needs' excludes water for productive activities within the household. The figure of 50 liters per person per day currently used as the minimum basic requirement (sometimes also seen as the free basic requirement) was from Gleick (1996), and can be broken as follows in Table 1. This table does not however seem to include water for laundry purposes which may represent a substantial volume in this water budget.

Table 1: Domestic water supply norms

Purpose	Recommended minimum (liters per person per day)
Drinking water	5
Sanitation services	20
Bathing	15
Cooking and kitchen	10
Total	50

A small sample showed that in Accra urban domestic water use (for household purposes) in low income settlements can vary between 25 and 60 liters/capita/ day. (Abraham *et al.*, 2007). If an individual is using water for a service sector enterprise, clearly they need more. Preliminary results show that depending on the size of the enterprise, they may use from 30 – 400 liters per day of additional water (Table 2), for an average business that is not excessively water consuming (eg various food related enterprises, hair salons and beauty parlors, livestock keeping). A study in Gujarat, India showed that this figure could represent an additional 20-1000 liters per day, depending on size and type of enterprise (Verhagen & Bhatt, 2006) These are substantial increases from the basic daily per capita use by the poor. In most of these enterprises studied in Accra, the contribution of income derived from this enterprise represents 100% of total household income, which emphasizes the importance of this enterprise to household livelihood.

Table 2 : Typical daily use of water for productive purposes in Accra

Description of enterprise (no. of enterprises interviewed	Water requirement (liters/day) [dependent on no]*	Access constraints described (when)
Tea and beverage (2)	34 – 140	Absence of water seller [intermittent]
Porridge (1)	270	Distance to water source [daily]
Fast food joint (3)	135 - 160	None
Chop bar (4)	170 - 370	Low water flows [intermittent]
Restaurant (2)	1000	Low water flows [intermittent]
Beauty salon (1)	200 - 400	Low flow [irregular]
Hairdressing salon (5)	140 - 280	Poor access or unreliable [intermittent]
Livestock (5)	220 – 350	Poor access
Car washing (3)	1600 - 7300	Unreliable [intermittent

* volumes depend on numbers served but these figures represent the additional amounts of water that are taken out of the system for productive use.

Wastewater

Though sanitation coverage in the city is 88% with only 12% being un-served, the high figure does not reflect the fact that only 14% percent of the households have individual improved toilets (GSS 2005). The rest use shared facilities with neighbours, or more often, given the poverty conditions and space limitations, public facilities. But many of the latter may not be functional. Only 15% of the Accra Municipal area is sewered, thus most fecal sludge from the toilets is disposed of into the sea or at a sludge disposal site, both within the city. However greywater is discharged into drains and storm sewers. A small study carried out in Accra indicated that 53% of the population disposed of their grey-water directly into gutters and storm-drains. All this greywater supplemented by direct discharges from septic tanks and public toilets in low income areas, eventually empties into the stream and river network in and around the city, that serve as water sources for irrigated urban vegetable production.

It is estimated that a total of about 100,000 m^3 per day of wastewater is generated, though this is based on an average per capita daily consumption of 76 liters (MoWRWH, 1998), and a wastewater return flow of 80%. A portion of which is re-used by farmers. In Accra about 680 ha are under maize, 47 ha under vegetables and 251 ha under mixed cereal-vegetable systems. In addition about 50-70 ha are distributed over 60% of Accra's households (80,000 tiny backyards). Plot sizes under cultivation in the city range from 0.01-0.02 ha per farmer, and increase up to 2.0 ha in peri-urban areas. In Accra practically any open space is used for farming vegetables and other crops because of the high demand from the city. It is estimated that 800-1,000 farmers earn an income from this activity (Obuobie *et al.*, 2006). Based on the mentioned irrigated areas, the annual volume of wastewater that is used in Accra in urban and peri-urban agriculture is estimated to be 4.4 MCM (Million Cubic Meters) (Abraham *et al.*, 2007).

Appreciating productive/multiple uses of urban water and wastewater

Similarities in use between large and small cities

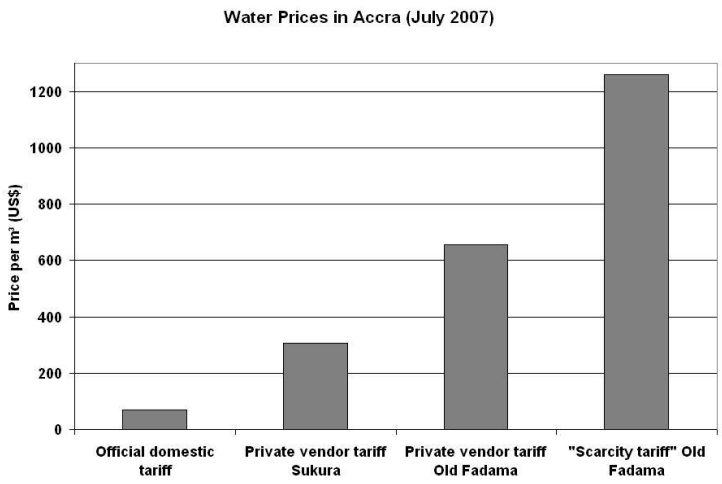
Productive use of water is not very different between small towns and big cities with large low income settlements, which have certain needs that the service enterprises discussed above, cater to. In a small town context in Vietnam, Noel *et al.*, (2006) report livestock keeping, preparation of food products and drinks typical to the country, and services like various types of eateries and snack bars, tea and coffee shops and of course beauty parlors and hair salons. Similarly in South Africa, the urban small town context has a similar cross section of business enterprises, which are also likely to be similar across countries and continents.

Incremental costs of supply are minimal, so why not plan for it?

Making the point that incremental costs are minimal, can encourage city water supply planners and water utilities to plan for catering to the additional need. An example from South Africa clearly Illustrates this (Moriarty and Butterworth, 2003b). According to their findings, once the capital costs for the system had been met, the extra capital cost implied in designing a system to supply 60 l/p/d from roof tanks compared to 25 l/p/d from yard tanks was Euro 96[1] per household even after including the extra O&M costs over a 20 year period. For this extra cost, an additional 35 l/p/d is available, equivalent to over 1,500 m^3 over twenty years! The combined additional cost per m3 was therefore Euro 0.11 (excluding capital repayment).

Unrestricted productive uses of domestic water may not always be positive and desirable specially where it is unplanned and where it uses water from under-designed 'domestic' systems. So, by explicitly recognizing that productive use is inevitable, it is possible to include it in planning and demand management. This is particularly relevant for Accra where urban water supply is already constrained. Moreover, since many of the people using water for productive purposes are within the low income bracket, including it in demand management could better secure access to water, which is one factor contributing to the sustainability of productive water use.

Figure 1. Comparison of water tariffs between official domestic and those measured in the low income areas of Sukura and Old Fadama in Accra (Van Rooijen *et al.*, 2008)



Forms of privatization, and its influence on productive use

It is recognized (by the World Bank and United Nations) that it is extremely difficult for a water utility, to operate a water service profitably and at the same time provide affordable services. Privatization is said to have failed because designing tariffs that do not discriminate against the poor are hard to achieve in practice (Solo, 1999). Whilst this may be so, it must be noted that in cities like Accra, even if the poor paid the commercial tariffs of privatized water supply, they would still be paying **less** than what they pay presently to small scale service providers.

In Figure 1, we see the price difference for water paid from different sources in two low income areas of Accra: the official domestic tariff of Ghana Water Company Limited (GWCL) is at 0.70 USD per cubic meter. The price that is paid for water if it is bought from private vendors is more than four times the official

tariff in Sukura, at 3 USD per cubic meter, compared to 9 times the price in Old Fadama. This price differential is influenced by the fact that Sukura is a formal low income settlement, with some water supply infrastructure laid on, whereas Old Fadama is an informal settlement where water supply infrastructure is officially not permitted. There is a monopoly amongst private vendors and price is agreed upon by the water vendors alone. In times of scarcity, which is a couple of times every month in the dry season, the price in Old Fadama goes up to 12 USD, which is 18 times the official price for domestic users (Van Rooijen *et al.*, 2008).

It is clear that it is the 'other private sector' of small scale water providers who benefit from exploiting the poor, thereby cutting into the profit margins of small entrepreneurs. Usually these water providers are (1) the families with water connections who provide services to their neighbors (in Bamako such providers are responsible for 25% of the city water supply); or (2) water points managed by individuals, or (3) water tankers who supply to households and to the small water enterprises (who in turn re-sell, keeping a profit margin). Considering that the poor pay anything between 4 to 18 times the official water prices, it is likely that they will be willing to pay in order to access water for their livelihoods. If private water utilities were able to provide the service, even at non-subsidized rates, it is likely that the poor will still benefit. A key solution lies in a more competitive private water sector market, which will eventually lead to lower water prices for the poor.

Other constraints to productive use of urban water

Noel et al (2007) report that other constraints can limit the effectiveness of these enterprises even if water were not a limiting factor. The two most relevant to the Accra context would be:

- Poor access to capital and credit for investment - the poor reported difficulty securing loans for micro-enterprise start-up costs;
- Skills, technical knowledge, and education.

Use of wastewater

The two main uses seen in Accra were washing of vehicles and irrigated urban farming. An interesting perspective is that with wastewater the term multiple use is less applicable compared to the term productive use. And even unlike with domestic water the term 'productive' has a special connotation given that normally wastewater is 'non productive'. New approaches like ecological/sustainable sanitation, and design for re-use (which is an emerging concept) enshrine productivity of wastewater in their definitions. Accepting that even wastewater is seen as a resource by the poor in developing country contexts (Scott et al, 2004, IWMI, 2006, Raschid-Sally and Jayakody, 2008); it is imperative that urban livelihood analyses take cognizance of this and provide assistance to farmers and other users to mitigate the risks of such use. From and urban livelihoods perspective it is not so much a matter of providing the wastewater (which is 'freely' available in developing country contexts), as a matter of managing the wastewater related risks. In the case of irrigated agriculture, simple and cost effective methods have been tested (Drechsel et al, 2008) and are available, in line with WHO (2006) guidelines for safe use of wastewater excreta and greywater, which reduce the health risks to farmers and consumers.

Planning for multiple use of urban water

Using the insights and experiences gained from the case of Accra, a simplified framework for analyzing productive use of urban water is presented. Urban water is viewed within the urban water cycle with particular reference to water supply and wastewater generation. The two main steps in determining and addressing productive uses of urban water are:

1. Determining types of small scale multiple, uses using the sustainable livelihood based approach
2. Ensuring sustainability through water demand planning and wastewater risk management.

Determining types of small scale multiple uses using the sustainable livelihood approach

A sustainable livelihood based approach focuses on determining people's *actual* water needs and uses, the constraints they face in accessing water supply and thereafter designing an environmentally, socially and economically sustainable action/solution to meet these water needs and uses (see Figure 2 and Box 1 for an explanation of the livelihood framework elements).

Box 1: Key livelihoods concepts explained

Assets are usually broken down into five categories: human capital, natural capital, financial capital, social capital, and physical capital. Political capital is sometimes included under social, sometimes explicitly added as a sixth capital.

Shocks, trends and seasonality (or the vulnerability context): Shocks are sudden events, usually with negative impacts, and include things like natural disasters, civil conflict, losing one's job, a collapse in crop prices for farmers etc. Trends emerge over a longer period of time and examples include increasing population pressure, deforestation, declining commodity prices, increasing accountability of government and technological trends Seasonal changes are important in relation to the value, availability, and productivity of natural capital and human capital (through sickness, hunger etc)

Policy, Institutions and Processes: Policies, Institutions and Processes embrace a complex range of issues associated with power, authority, governance, laws, policies, public service delivery, social relations – gender, caste, ethnicity – institutions – laws, markets, land tenure arrangements – and organizations – NGOs, government agencies, private sector. These effectively determine access to various types of capital, and to decision-making bodies and sources of power, which influence the livelihood strategies adopted by individuals and households, and ultimately the returns to the pattern of livelihoods adopted.

Livelihood activities include all the activities that people engage in as part of making their living. They include farming crops and livestock, selling forest products, wage labor work etc.

Livelihood strategies are the full portfolio of livelihood activities, but linked to an understanding of the choices and decisions underlying them. They include: how people combine their income generating activities; the way in which they use their assets; which assets they chose to invest in; and how they manage to preserve existing assets and income.

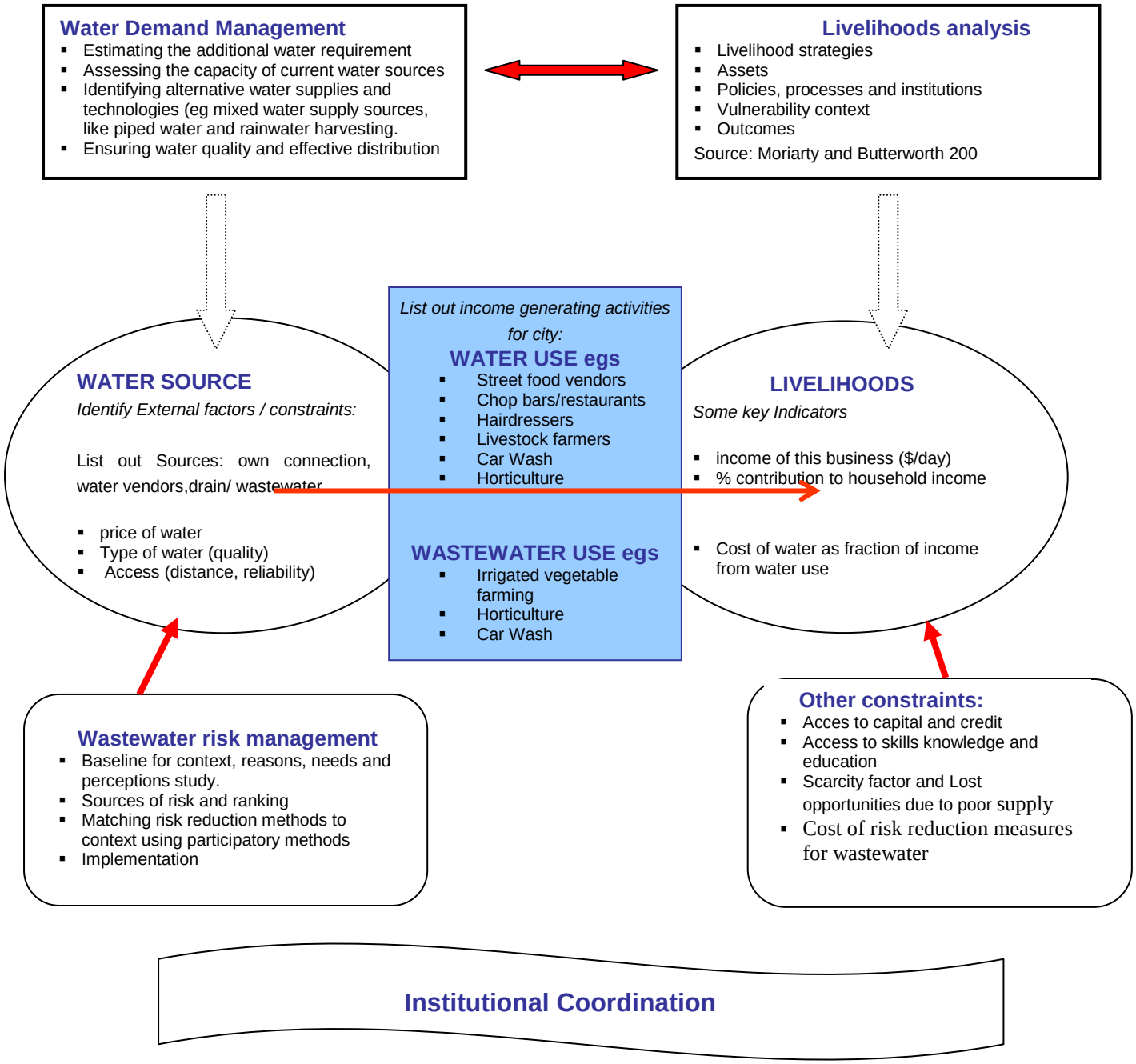
Livelihood outcomes are the achievements – the results – of livelihood strategies. These may include more income, increased well-being, reduced vulnerability, improved food security, more sustainable use of the natural resource base, improved social relations and status, and more dignity and (self)respect.

Source: summarized from Moriarty and Butterworth (2003b)

The first step in such a process is identifying the low income settlements within the city as these are the areas where service enterprises are concentrated, and also the areas which are poorly served by water supply systems. Thereafter a consultation mechanism should be implemented for each area to establish the following:

- The different types of small scale multiple uses in the area;
- The source of the water, namely is it domestic water directly from the scheme, or from a private water vendor, or wastewater;
- Volume and tarification: the volume of water used per activity; and the price paid;
- The contribution of the business to the household income;
- The fraction of total costs that is spent on buying water (indicating the importance of water for the livelihood activity);
- Accessibility and quality: accessibility (time and effort spent on getting the water), means of transporting the water from its point of origin to the place of final use; and the quality of the water used;
- Gender, age, and social exclusion related issues;
- Other factors that may influence the viability of the activity like access to credit and financing, availability of other relevant non-water related infrastructure, production tools, etc.

Figure 2 : Simplified analytical framework for quantifying productive use of urban water and wastewater



Ensuring sustainability through water demand planning, wastewater risk management and institutional coordination

Once the actual water needs and the different types of small scale multiple uses of water for a community, have been established, the next step is proposing the necessary interventions to improve water access. In planning for the increased water demand, the water supply authority should ensure that the resource can sustain the increase in consumption. At the city level, plans for increasing water supply to these communities have to be drawn up and the related infrastructure needs have to be identified. It is advisable that all potential water sources are considered. The impact on the catchment from increased abstraction for urban water supply has to be evaluated. The approach to supply management must thus be holistic, incorporating livelihoods considerations for poverty reduction and well being. New investments should target better distribution of the resource specially in low income areas, to create better access and subsequently lower water prices, instead of merely boosting water supply (Van Rooijen *et al.*, 2008).

The other two factors for sustainability are wastewater risk management and institutional coordination. The former has to be undertaken to identify the key entry points for reducing the risks resulting from wastewater use for livelihoods. The latter is essential as we are at the meeting point of water supply, wastewater/sanitation and agriculture with city planning authorities, and the health sector also playing an important role. Each of these is detailed below.

Water demand planning

Once the community's actual water needs have been established the water supply authority should consider the best and most efficient method, of supplying the water to meet the demand. In designing a sustainable and water efficient multiple water use supply system the following water supply considerations must be kept in mind:

- Confirmation that the resource can supply the additional supply requirements;
- Ensuring that the quality of the water is maintained, especially if other sources besides conventionally treated water are used;
- The most appropriate water abstraction and transfer mechanism;
- The identification of alternative water supply sources if necessary, and technologies to meet the water demand and quality requirements in an environmentally, socially and economically sustainable manner;
- The possibility of using mixed water supply sources such as piped water and rain water harvesting to meet demand needs and,
- The best location for the water supply points to satisfy the water demand and ensure effective distribution.

Wastewater risk management

The following steps are suggested to manage the risks from wastewater use. Various complex risk management frameworks are available in literature which can be simplified and modified for wastewater risk management in the case of productive use of wastewater.

- Baseline survey of livelihood activities using wastewater, to understand the context and reasons for its use, and the needs and perceptions of users;
- Identifying the sources of risk and ranking them by order of magnitude[2;]
- Matching tested simple cost effective methods for risk reduction (WHO, 2006) to the local context, and adapting them using participatory methods with the end users;
- Implementing these methods.

Institutional coordination

Urban livelihoods analyses should be an integral part of city planning. A platform for coordination is necessary at this level, which includes the stakeholders from the different sectors mentioned. In order to avoid duplication, if an existing platform is available, then the missing stakeholders can be co-opted when urban livelihoods issues are on the agenda.

Concluding remarks

It is now clearly recognized that domestic water services in rural and community settings have multiple benefits and some measures are being put in place to cater to these needs. What is less well recognized is that this is equally so in urban contexts – probably more so, as rural urban migration comes with certain expectations for the poor and many urban water dependent livelihoods are their only recourse. The few

studies in literature show that they have an appreciable impact on livelihoods and poverty (Noel *et al.*, 2006, Verhagen and Bhatt, 2006).

Productive uses of domestic water and wastewater often occur in the less-visible informal sector that caters to the lower income groups. In the case of water supply, most planners and engineers are not even aware that such use may represent a large water requirement especially in poorly served systems. Furthermore planners use norms for designing systems but current norms do not include such use, hence they are being left out of water allocation priorities. In the case of wastewater, authorities usually ignore such use, as it is difficult to control, thus inadvertently contributing towards sustaining the risk.

Narrow approaches to water supply and wastewater use, that neglect productive uses of urban water, can be seen as missed opportunities for addressing urban poverty. Additionally failure to account for this additional demand at the design stage may well lead to system failure in some cases.

Accepting the potential for productive uses of urban water clearly means an increased demand by small-scale users, even where waste has been curtailed. As Table 2 shows, this increased demand, is sometimes substantial compared to the individual domestic use, depending on the size of the enterprise and the type of livelihood activity. It may be argued however, that in the larger water supply context, these additional volumes will represent only a small increase in the supply, compared to the volume of water used for domestic activities. However the importance of this water to household income generation must not be underestimated.

From preliminary findings we conclude that the interests of people who use domestic water for livelihood purposes can be better accounted for under conditions of improved access, which will reduce the price they pay for water and increase their profit margin. The constraining factor for making productive use of water is not so much water shortage, as inequity of water access in the city.

Ensuring sustainability of urban livelihoods requires consideration of three factors: sufficient provision of water, managing the risks from wastewater, and institutional coordination. In the absence of any one of these factors the system is likely to breakdown.

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Note/s

[1] 2003 rates. Currently 1 Euro = 1.42 USD

[2]We are not suggesting here that quantitative and comprehensive risk assessments are done which are complicated and costly, but that an understanding of the sources and a ranking of these is carried out using simple indicators for quantification.

Keywords

Urban water use, wastewater, urban poverty, livelihoods, privatisation

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